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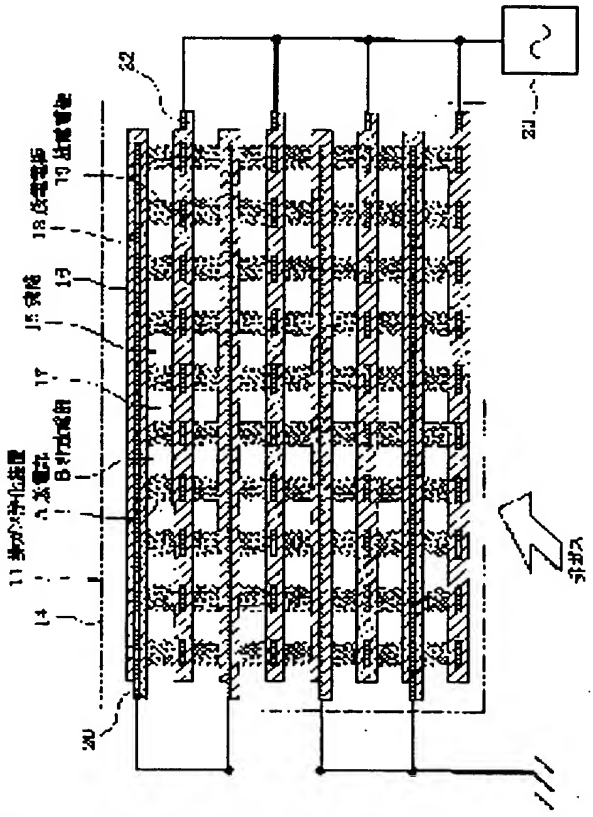
(54) EXHAUST EMISSION CONTROL DEVICE FOR INTERNAL COMBUSTION ENGINE

(57)Abstract:
PROBLEM TO BE SOLVED: To enable efficient exhaust emission control by using electric discharge.
SOLUTION: Insulating substrate 16, 17 are arranged in parallel with a prescribed space, a flow path 15 for exhaust gas is formed between each insulating substrate 16, 17, also coating of a catalyst is applied to a surface of each insulating substrate 16, 17. Each flow path 15 is provided with by mixing a part (discharge part A generating discharge) counter posing discharge electrodes 18, 19 embedded in the insulating substrates 16, 17 and a nondischarge part B generating no discharge. Since a purifying window of the discharge part A exists in a region of temperature which is lower than that of a purifying window of the nondischarge part B (catalyst), exhaust gas is purified mainly in the discharge part A in a spot of temperature lower than the purifying window of the nondischarge part B, on the contrary, exhaust gas is purified mainly in the nondischarge part B in a spot



of temperature higher than the purifying window of the discharge part A. In this way, in whatever way the distribution of temperature may change in this exhaust gas purifier device 11, the exhaust gas can be purified in either one of the discharge part A or the nondischarge part B.

* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1]By making two or more discharge electrodes counter across a channel through which exhaust gas of an internal-combustion engine flows, and generating discharge in this channel. Said discharge electrode is constituted so that a portion (henceforth a "discharge section") which discharge produces in said channel, and a portion (henceforth "a non-discharge section") which discharge does not produce may be made intermingled in a diesel-particulate filter of an internal-combustion engine which purifies exhaust gas, A diesel-particulate filter of an internal-combustion engine providing a catalyst in a non-discharge section at least.
[Claim 2]A diesel-particulate filter of the internal-combustion engine according to claim 1, wherein an internal surface of said channel is coated with said catalyst.
[Claim 3]A diesel-particulate filter of the internal-combustion engine according to claim 1 or 2 changing a ratio of said discharge section and said non-discharge section according to temperature distribution in a diesel-particulate filter.
[Claim 4]A diesel-particulate filter of the internal-combustion engine according to any one of claims 1 to 3 constituting so that the upstream part of said discharge section in a diesel-particulate filter may become less than a downstream.
[Claim 5]A diesel-particulate filter of the internal-combustion engine according to any one of claims 1 to 4 constituting so that the center section of said discharge section in a diesel-particulate filter may become less than a periphery.
[Claim 6]A diesel-particulate filter of the internal-combustion engine according to any one of claims 1 to 5, wherein all the exhaust gas which flows through inside of said channel has arranged said discharge section and said non-discharge section once [at least] so that a discharge section may be passed.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the diesel-particulate filter of the internal-combustion engine which promotes the cleaning reaction of exhaust gas using discharge.
[0002]
[Description of the Prior Art]In recent years, the new emission-gas-purification art which purifies exhaust gas using spark discharge energy is studied. For example, arranging two or more plate electrodes in parallel with a prescribed interval, impressing alternating current high voltage between each discharge electrode, and forming uniform discharging space in a discharge system diesel-particulate filter, as shown in a U.S. Pat. No. 5746051 gazette. There are some which purified exhaust gas by passing exhaust gas to the channel between each discharge electrode.
[0003]
[Problem(s) to be Solved by the Invention]Although the temperature requirement called the purification window where a purifying rate becomes high with temperature like catalytic converters, such as a three way component catalyst, also in such a discharge system diesel-particulate filter exists and a high purifying rate is acquired in this purification window, When it separates from a purification window, there is the characteristic that a purifying rate falls rapidly. When it becomes an elevated temperature rather than a purification window especially, nitrogen (N_2) in exhaust gas will oxidize with high temperature and spark discharge energy, nitrogen oxides (NOx) will be generated, and there is a possibility that NOx emission may increase.
[0004]Therefore, only with a discharge system diesel-particulate filter, when it becomes the temperature requirement which separated from the purification window, exhaust gas cannot fully be purified. Then, as shown in JP,6-10652,A, when emission temperature is below preset temperature combining discharge system diesel-particulate filter and catalytic converter, Operating a discharge system diesel-particulate filter and discharge purifying exhaust gas, and turning off discharge and purifying exhaust gas with a catalytic converter, when emission temperature is higher than preset temperature is proposed.
[0005]However, the whole has the tendency for temperature to become high rather than a downstream in the upstream part near an engine rather than it carries out the temperature change of the diesel-particulate filter uniformly, and there is a tendency for the temperature gradient of an upstream part and a downstream to become large especially at the time of acceleration. Therefore, even if the temperature of an upstream part exceeds preset

temperature, the temperature of a downstream has a case below preset temperature, and when discharge of the whole device is turned off in such a case, the rate of emission gas purification may fall on the contrary. But when the preset temperature of discharge turning on and off is set as a high temperature and the OFF stage of discharge is delayed, there is a possibility that the temperature of an upstream part may be an elevated temperature too much, and NOx may be generated, and there is a possibility that NOx emission may increase on the contrary. In short, since it changes variously and the temperature gradient in a diesel-particulate filter becomes large easily by the emission temperature and the exhaust gas flow rate which change according to an engine operation condition, the temperature distribution in a diesel-particulate filter is difficult to turn discharge of the whole device on and off properly with temperature. And it is necessary to constitute a control system so that discharge may be turned on and off based on the output of a temperature sensor, and the temperature sensor which detects the temperature in a diesel-particulate filter is needed, and there is a fault which becomes a high cost generally.

[0006]This invention is made in consideration of such a situation, and therefore, the purpose, An always high purifying rate can be acquired, without seldom being influenced by the temperature distribution in a diesel-particulate filter, and it is in providing the diesel-particulate filter of the internal-combustion engine which can simplify composition and can also fill the demand of low-cost-izing.

[0007]

[Means for Solving the Problem]To achieve the above objects, claim 1 of this invention constitutes a discharge electrode so that a portion (henceforth a "discharge section") which discharge produces in a channel in a diesel-particulate filter, and a portion (henceforth "a non-discharge section") which discharge does not produce may be made intermingled, and it has composition which provided a catalyst in a non-discharge section at least. If it does in this way, exhaust gas which flows through a channel in a diesel-particulate filter, In a process in which pass a discharge section and a non-discharge section and a discharge section is passed, a cleaning reaction is promoted by discharge (a cleaning reaction promoted by both discharge and catalyst when a catalyst exists in a discharge section), it is a process in which a non-discharge section is passed, and a cleaning reaction is promoted by catalyst.

[0008]As shown in drawing 6, generally a purification window of a discharge section, Since it exists in a temperature region lower than a purification window of a non-discharge section, in a place of a temperature lower than a purification window of a non-discharge section, exhaust gas is purified mainly by a discharge section, and exhaust gas is mainly purified by non-discharge section on the contrary at a place of a temperature higher than a purification window of a discharge section. Therefore, if a discharge section and a non-discharge section are made intermingled, even if temperature distribution in a diesel-particulate filter will change how, exhaust gas can be purified by non-either a discharge section or a discharge section, and an always high purifying rate can be acquired, without seldom being influenced by temperature distribution in a diesel-particulate filter. And since it is not necessary to turn discharge on and off according to temperature, a temperature sensor is unnecessary, composition is easy, and a demand of low-cost-izing can also be filled.

[0009]In this case, although a catalyst may be filled up with a thing of a pellet type in a channel, it may be made to coat an internal surface of a channel with a catalyst like claim

2. If it does in this way, an exhaust back pressure (pressure loss) in a channel can be lessened, and it is not necessary to reduce an engine output.
[0010]It may be made to change a ratio of a discharge section and a non-discharge section like claim 3 according to temperature distribution in a diesel-particulate filter. For example, at a place of a tendency for temperature in a diesel-particulate filter to become high, a ratio of a non-discharge section whose temperature of a purification window is higher than a discharge section is increased, and it is good to increase a ratio of a discharge section whose temperature of a purification window is lower than a non-discharge section on the contrary at a place of a tendency for temperature to become low. If it does in this way, exhaust gas can be purified according to temperature distribution in a diesel-particulate filter, using a discharge section and a non-discharge section efficiently, and a rate of emission gas purification can be raised.
[0011]In this case, like claim 4, it may constitute so that the upstream part of a discharge section in a diesel-particulate filter may become less than a downstream. That is, the whole does not carry out the temperature change of the diesel-particulate filter uniformly, If it constitutes so that the upstream part of a discharge section may become less than a downstream since there is a tendency for temperature to become high rather than a downstream in the upstream part near an internal-combustion engine, a ratio of a discharge section and a non-discharge section can be made to correspond to temperature distribution of an exhaust gas flow direction.
[0012]Generally, an exhaust gas flow rate in a diesel-particulate filter is not uniform, in the center section, it decreases in a periphery, and a center section with many exhaust gas flow rates has the tendency for temperature to become high rather than a periphery with few exhaust gas flow rates.
[0013]In consideration of this point, like claim 5, it may constitute so that the center section of a discharge section in a diesel-particulate filter may become less than a periphery. If it does in this way, it can be made to correspond to temperature distribution which produces a ratio of a discharge section and a non-discharge section according to exhaust gas flow rate distribution.
[0014]Like claim 6, all the exhaust gas of at least 1 time which flows through inside of a channel is good to arrange a discharge section and a non-discharge section so that a discharge section may be passed. If it does in this way, all the exhaust gas which flows through inside of a channel can be certainly exposed to discharging space, and an exhaust gas cleaning effect by discharge can be heightened.
[0015]
[Embodiment of the Invention][Embodiment (1)] The embodiment (1) of this invention is hereafter described based on drawing 1 thru/or drawing 6. As shown in drawing 5, the diesel-particulate filter 11 is formed in the middle of the exhaust pipe 13 of the engine 12 which is an internal-combustion engine. The purification housing 14 of this diesel-particulate filter 11 is formed more thickly than the exhaust pipe 13, in order to form many channels 15.
[0016]As shown in drawing 1, in the purification housing 14, two kinds of insulating substrates 16 and 17 are arranged in parallel by turns with a prescribed interval, and the flat channel 15 through which exhaust gas passes between each insulating substrate 16 and 17 is formed. Each insulating substrates 16 and 17 are formed with the existing heat-resistant insulators (for example, ceramics, such as alumina, glass, etc.) of the dielectric

which discharge tends to produce, and the surface (internal surface of the channel 16) of each insulating substrates 16 and 17 is coated with the catalyst (not shown) which promotes the cleaning reaction of exhaust gas.

[0017]As shown in drawing 2 and drawing 3, two or more discharge electrodes 18 and 19 are formed in the inside of each insulating substrates 16 and 17 of a printed conductor or plate conducting. As the insulating substrate 16 of the upper surface of each channel 15 or the undersurface is shown in drawing 2, it is formed so that two or more band-like discharge electrodes 18 may be prolonged at an exhaust gas flow direction and a right angle, and each discharge electrode 18 is connected to the connecting terminal section 20 formed in the left edge part of this insulating substrate 16. This insulating substrate 16 and the insulating substrate 17 which counters, As shown in drawing 3, it is formed so that two or more band-like discharge electrodes 19 may be prolonged in an exhaust gas flow direction and parallel, and the end of each discharge electrode 19 is connected with this by the connected conductors 21 formed in one, and these connected conductors 21 are connected to the connecting terminal section 22 formed in the right end section of the insulating substrate 17.

[0018]As shown in drawing 1, the connecting terminal section 20 of the insulating substrate 16 by the side of one side of each channel 15 is connected to the ground side, and the connecting terminal section 22 of this insulating substrate 16 and the insulating substrate 17 which counters is connected to the output terminal of the high-voltage transformer assembly 23 which generates the alternating current high voltage of high frequency, for example. Thereby, at the time of operation of the high-voltage transformer assembly 23, the alternating current high voltage of high frequency is impressed between the discharge electrodes 18 and 19 band-like [two or more] which counter across each channel 15, and discharge occurs in each channel 15.

[0019]In this case, since the discharge electrodes 18 and 19 of the upper and lower sides which counter across each channel 15 are located in a line so that it may see and intersect perpendicularly from the upper part, discharge occurs only in the portion (portion which saw and overlapped from the upper part) which the up-and-down discharge electrodes 18 and 19 counter, and discharge does not generate them in the other portion. Thereby, in each channel 15, the discharge section A which discharge generates, and the non-discharge section B which discharge does not generate are intermingled. According to this embodiment (1), as shown in drawing 4, many discharge sections A are arranged with a prescribed interval in all directions in the channel 15, and the non-discharge section B is formed so that the circumference of each discharge section A may be surrounded.

[0020]In this embodiment (1) described above, since the discharge section A and the non-discharge section B are intermingled in each channel 15 in the diesel-particulate filter 11, the exhaust gas which flows through each channel 15, A cleaning reaction is promoted by both catalysts of discharge and channel 15 wall in the process in which pass the discharge section A and the non-discharge section B, and the discharge section A is passed, and a cleaning reaction is promoted by the catalyst in the process in which the non-discharge section B is passed.

[0021]As shown in drawing 6, generally the purification window of the discharge section A, Since it exists in a temperature region lower than the purification window of the non-discharge section B, in the place of a temperature lower than the purification window of the

non-discharge section B, exhaust gas is purified mainly by the discharge section A, and exhaust gas is mainly purified by the non-discharge section B on the contrary at the place of a temperature higher than the purification window of the discharge section A. Therefore, if the discharge section A and the non-discharge section B are made intermingled in each channel 15, even if the temperature distribution in the diesel-particulate filter 11 will change how, Exhaust gas can be purified by non-either the discharge section A or a discharge section B, and an always high purifying rate can be acquired, without seldom being influenced by the temperature distribution in the diesel-particulate filter 11. And since it is not necessary to turn discharge on and off according to temperature, a temperature sensor is unnecessary, composition is easy, and the demand of low-cost-izing can also be filled.

[0022][Embodiment (2)] In the above-mentioned embodiment (1), since the non-discharge section B is prolonged to the both ends of the channel 15 along the exhaust gas flow direction as shown in drawing 4, there is a possibility that a part of exhaust gas which flowed in the diesel-particulate filter 11 may flow out of the diesel-particulate filter 11 through the non-discharge section B.

[0023]By then, the thing which you arrange the insulating substrate 16 of drawing 2 to two or more sheet parallel with a prescribed interval, and is made for the discharge electrode 18 of the upper and lower sides of each channel 15 to counter in the embodiment (2) of this invention. As shown in drawing 7, two or more band-like discharge sections A are formed in the channel 15 so that it may extend at an exhaust gas flow direction and a right angle in a prescribed interval, and the non-discharge section B is formed between each discharge section A.

[0024]In this composition, since the discharge section A and the non-discharge section B crossed the channel 15 right-angled and are prolonged to those both the right and left ends, all the exhaust gas which flows through the inside of the channel 15 certainly comes to pass both the discharge section A and the non-discharge section B, and a higher purifying rate can be acquired.

[0025][Embodiment (3)] in the embodiment (3) of this invention shown in drawing 8 and drawing 9. The insulating substrate 31 is followed alternately, the discharge electrode 32 is formed in it, this insulating substrate 31 is arranged to two or more sheet parallel with a prescribed interval, and by making the discharge electrode 32 of the upper and lower sides of each channel 15 counter, as shown in drawing 9, the discharge section A and the non-discharge section B are alternately formed in the channel 15. All the exhaust gas which flows through the inside of the channel 15 certainly comes to pass both the discharge section A and the non-discharge section B as well as said embodiment (2), and this embodiment (3) can also acquire a higher purifying rate.

[0026][Embodiment (4)] The whole does not carry out the temperature change of the diesel-particulate filter uniformly, but there is a tendency for temperature to become high rather than a downstream in the upstream part near an engine. Then, in the embodiment (4) of this invention, as shown in drawing 10, form two or more band-like discharge sections A and the non-discharge section B in the channel 15 so that it may extend at an exhaust gas flow direction and a right angle by turns, and. It constitutes from forming the width of the discharge section A so that the direction of an upstream part may become narrower than a downstream so that the upstream part of the discharge section A may become less than a downstream. If it does in this way, exhaust gas can be purified

according to the temperature distribution in a diesel-particulate filter, using efficiently the discharge section A and the non-discharge section B, and the rate of emission gas purification can be raised.
[0027][Embodiment (5)] The exhaust gas flow rate in a diesel-particulate filter is not uniform, in the center section, it decreases in a periphery, and the center section with many exhaust gas flow rates has the tendency for temperature to become high rather than a periphery with few exhaust gas flow rates.
[0028]In consideration of this point, in the embodiment (5) of this invention. As shown in drawing 11, form two or more band-like discharge sections A and the non-discharge section B in the channel 15 so that it may extend at an exhaust gas flow direction and a right angle by turns, and. It constitutes from forming the width of the discharge section A so that the direction of a center section may become narrower than a periphery so that the center section of the discharge section A may become less than a periphery. If it does in this way, it can be made to be able to respond to the temperature distribution which produces the ratio of the discharge section A and the non-discharge section B according to exhaust gas flow rate distribution, and exhaust gas can be purified, using efficiently the discharge section A and the non-discharge section B.
[0029]Also in this embodiment (5), as well as said embodiment (4), the width of each discharge section A may be formed so that the direction of an upstream part may become narrower than a downstream, and it may constitute so that the upstream part of the discharge section A may become less than a downstream.
[0030]In addition, this invention is not limited to each above-mentioned embodiment, but may change suitably a discharge electrode, and the shape and the arrangement pattern of the discharge section A (the non-discharge section B), or may form the channel of exhaust gas in honeycomb shape.
[0031]Although both the discharge section A and the non-discharge section B are coated with the catalyst, the non-discharge section B may be coated with a catalyst in each above-mentioned embodiment. It may be made to be filled up with the pellet of a catalyst in a channel.

[Translation done.]

* NOTICES *

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3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The vertical section front view of the diesel-particulate filter of an embodiment (1)
[Drawing 2]The cross-sectional view of an insulating substrate
[Drawing 3]The cross-sectional view of the insulating substrate of drawing 2, and other insulating substrates made to counter
[Drawing 4]The top view showing the arrangement pattern of the discharge section A of an embodiment (1), and the non-discharge section B
[Drawing 5]The outline lineblock diagram of the whole exhaust gas purifying system
[Drawing 6]The purification characteristic figure explaining the relation between the purification window of the discharge section A, and the purification window of the non-discharge section B
[Drawing 7]The top view showing the arrangement pattern of the discharge section A of an embodiment (2), and the non-discharge section B
[Drawing 8]The cross-sectional view of the insulating substrate of an embodiment (3)
[Drawing 9]The top view showing the arrangement pattern of the discharge section A of an embodiment (3), and the non-discharge section B
[Drawing 10]The top view showing the arrangement pattern of the discharge section A of an embodiment (4), and the non-discharge section B
[Drawing 11]The top view showing the arrangement pattern of the discharge section A of an embodiment (5), and the non-discharge section B
[Description of Notations]
11 [-- Purification housing, 15 / -- A channel, 16 17 / -- An insulating substrate, 18 19 / -- A discharge electrode, 23 / -- A high-voltage transformer assembly, A / -- A discharge section, B / -- Non-discharge section.] -- A diesel-particulate filter, 12 -- An engine (internal-combustion engine), 13 -- An exhaust pipe, 14

[Translation done.]

* NOTICES *

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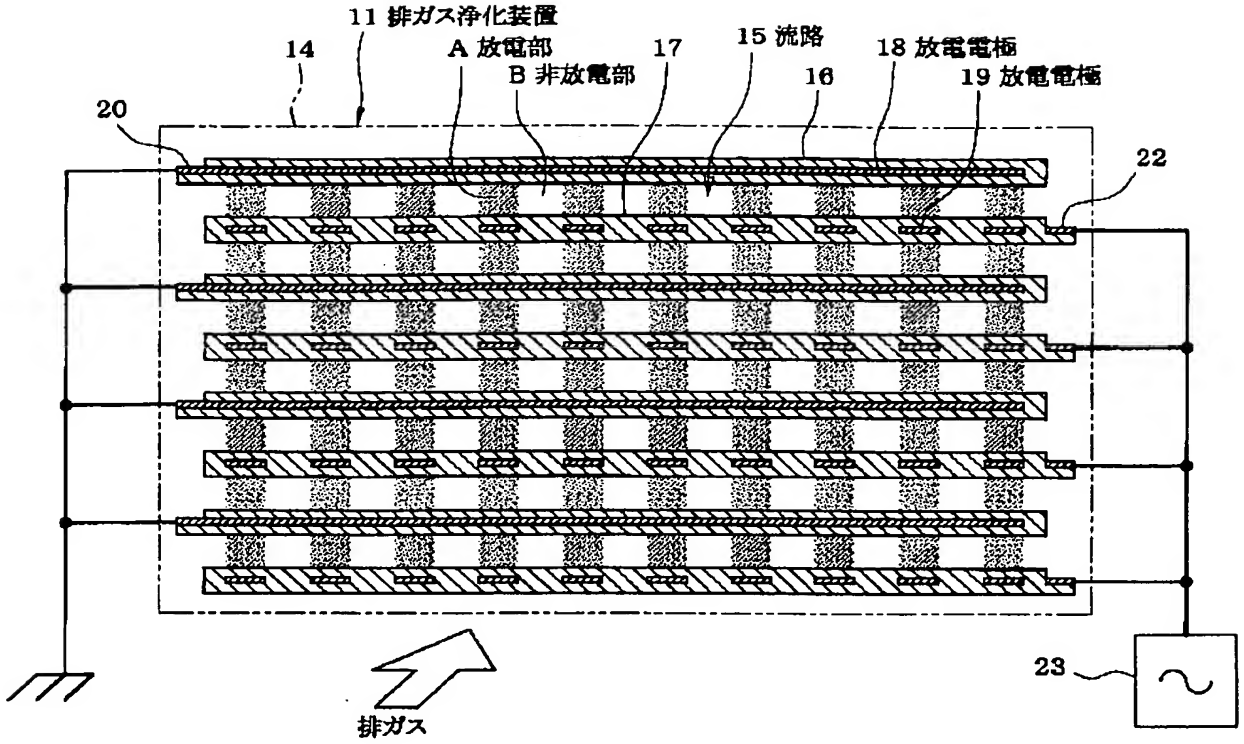
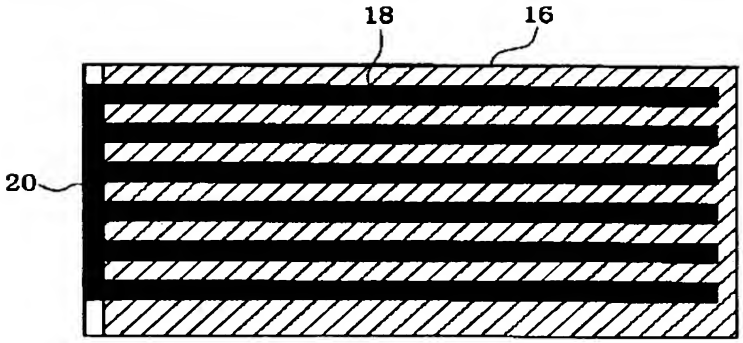
DRAWINGS

[Drawing 1]



[Drawing 2]



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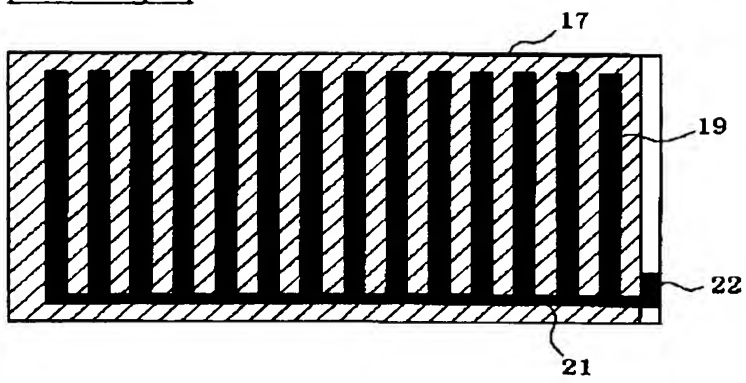

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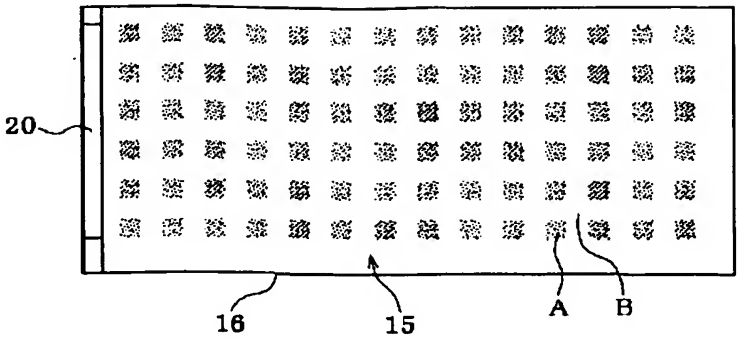

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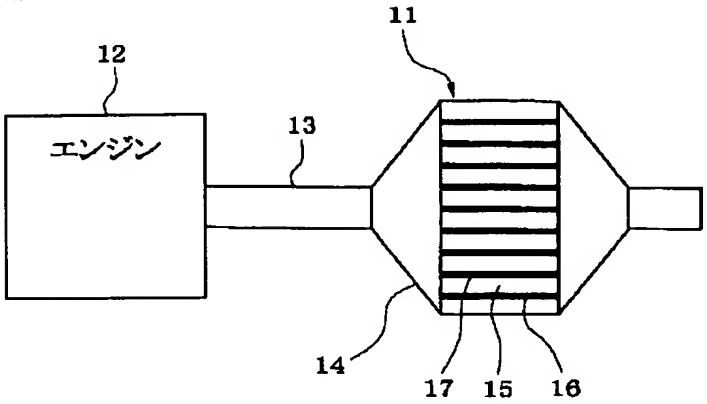
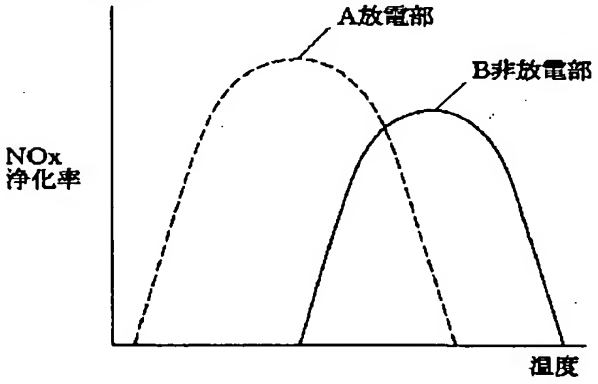
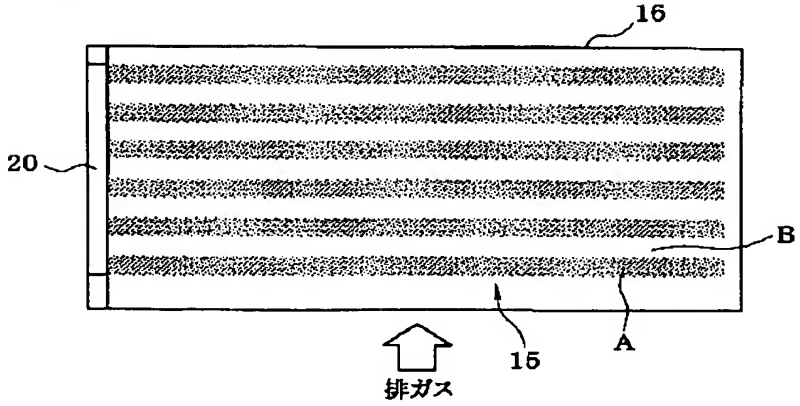


[Drawing 6]



[Drawing 7]



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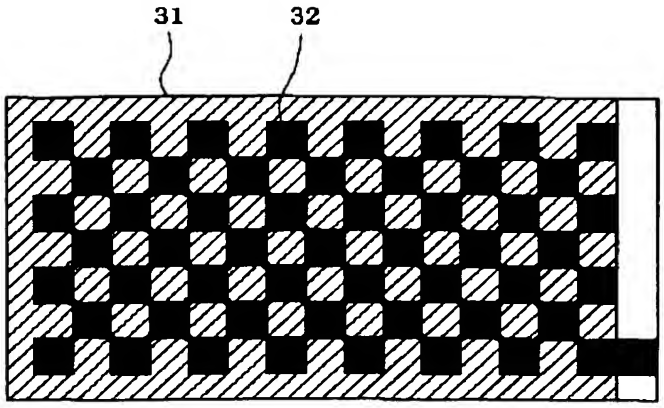
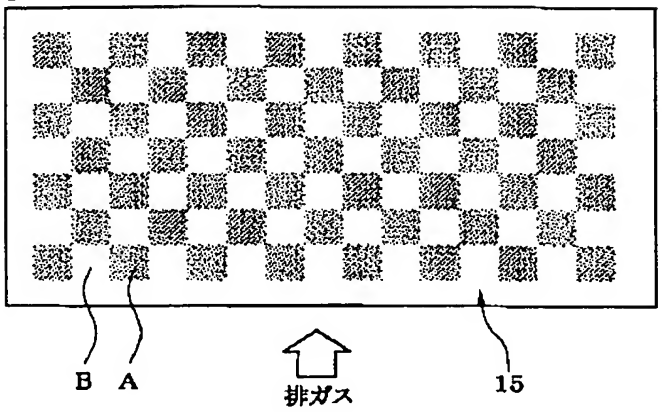
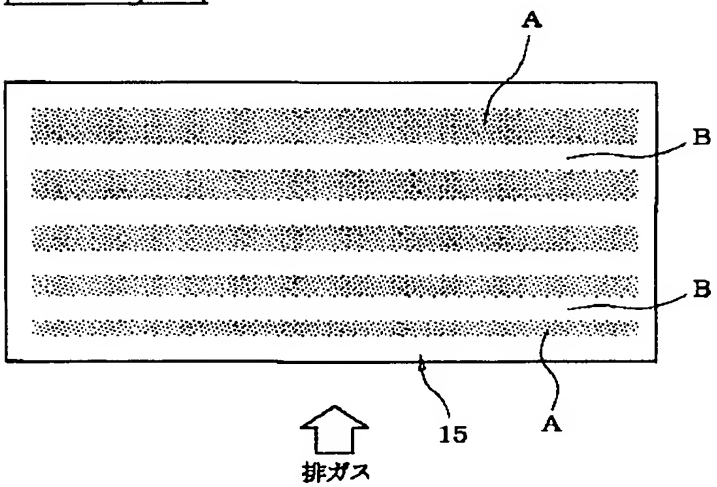


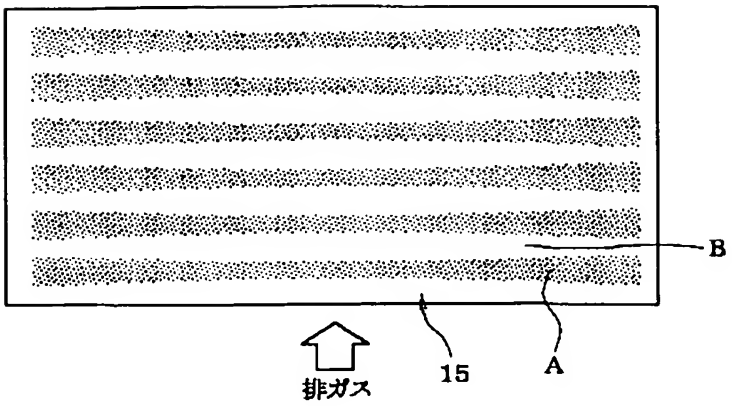
[Drawing 9]



[Drawing 10]



[Drawing 11]



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	53/94		3/28	３０１Ｃ	
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	3/28	３０１	Ｂ０１Ｄ 53/36	ＺＡＢＺ	

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弁理士　加古　宗男

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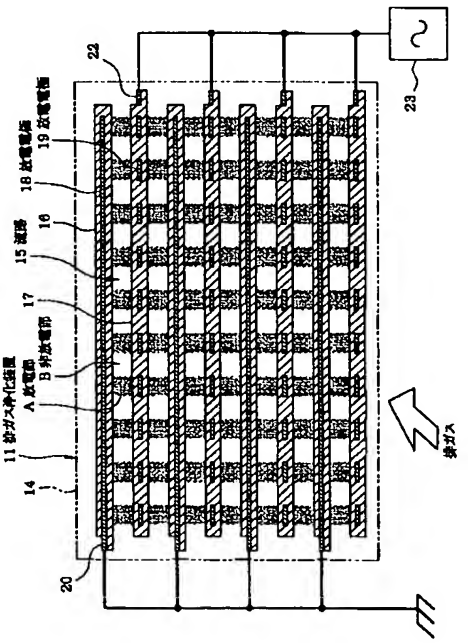
4D048 AA06 CC32 CC36 EA03

(54)【発明の名称】　内燃機関の排ガス浄化装置

(57)【要約】
【課題】　放電を用いて排ガスを効率良く浄化できるようにする。
【解決手段】　絶縁基板１６，１７を所定間隔で平行に配置し、各絶縁基板１６，１７間に排ガスの流路１５を形成すると共に、各絶縁基板１６，１７の表面に触媒をコーティングする。各流路１５には、絶縁基板１６，１７内に埋め込まれた放電電極１８，１９が対向する部分（放電が発生する放電部Ａ）と、放電が発生しない非放電部Ｂとを混在させる。放電部Ａの浄化ウインドウは、非放電部Ｂ（触媒）の浄化ウインドウよりも低い温度域に存在するため、非放電部Ｂの浄化ウインドウよりも低い温度の場所では、主として放電部Ａで排ガスが浄化され、反対に、放電部Ａの浄化ウインドウよりも高い温度の場所では、主として非放電部Ｂで排ガスが浄化される。これにより、排ガス浄化装置１１内の温度分布がどの様に変化したとしても、放電部Ａと非放電部Ｂのいずれかで排ガスを浄化できる。



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【特許請求の範囲】

【請求項１】　内燃機関の排ガスが流れる流路を挟んで複数の放電電極を対向させ、該流路内で放電を発生させることで、排ガスを浄化する内燃機関の排ガス浄化装置において、

前記流路に放電が生じる部分（以下「放電部」という）と放電が生じない部分（以下「非放電部」という）とを混在させるように前記放電電極を構成し、少なくとも非放電部には触媒を設けたことを特徴とする内燃機関の排ガス浄化装置。

【請求項２】　前記触媒は、前記流路の内壁面にコーティングされていることを特徴とする請求項１に記載の内燃機関の排ガス浄化装置。

【請求項３】　排ガス浄化装置内の温度分布に応じて前記放電部と前記非放電部との比率を変化させたことを特徴とする請求項１又は２に記載の内燃機関の排ガス浄化装置。

【請求項４】　排ガス浄化装置内の上流部の方が下流部よりも前記放電部が少なくなるように構成したことを特徴とする請求項１乃至３のいずれかに記載の内燃機関の排ガス浄化装置。

【請求項５】　排ガス浄化装置内の中央部の方が周辺部よりも前記放電部が少なくなるように構成したことを特徴とする請求項１乃至４のいずれかに記載の内燃機関の排ガス浄化装置。

【請求項６】　前記流路内を流れる全ての排ガスが少なくとも１回は放電部を通過するように前記放電部と前記非放電部とを配置したことを特徴とする請求項１乃至５のいずれかに記載の内燃機関の排ガス浄化装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、放電を利用して排ガスの浄化反応を促進させる内燃機関の排ガス浄化装置に関するものである。

【０００２】

【従来の技術】近年、放電エネルギを利用して排ガスを浄化する新たな排ガス浄化技術が研究されている。例えば、米国特許第５７４６０５１号公報に示すように、放電式の排ガス浄化装置内に複数の平板電極を所定間隔で平行に配置し、各放電電極間に交流高電圧を印加して一様な放電場を形成しながら、排ガスを各放電電極間の流路に流すことで、排ガスを浄化するようにしたものがある。

【０００３】

【発明が解決しようとする課題】このような放電式の排ガス浄化装置においても、三元触媒等の触媒コンバータと同様に、温度によって浄化率が高くなる浄化ウインドウと呼ばれる温度範囲が存在し、この浄化ウインドウ内では高い浄化率が得られるが、浄化ウインドウを外れると、急激に浄化率が低下するという特性がある。特に、

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浄化ウインドウよりも高温になると、排ガス中の窒素（N_2）が高熱と放電エネルギによって酸化されて窒素酸化物（ＮＯｘ）が生成されてしまい、ＮＯｘ排出量が増加してしまうおそれがある。

【０００４】従って、放電式の排ガス浄化装置のみでは、浄化ウインドウを外れた温度範囲になったときに排ガスを十分に浄化できない。そこで、特開平６－１０６５２号公報に示すように、放電式の排ガス浄化装置と触媒コンバータとを組み合わせて、排ガス温度が設定温度以下のときに、放電式の排ガス浄化装置を作動させて、放電により排ガスを浄化し、排ガス温度が設定温度より高いときには、放電をオフして触媒コンバータで排ガスを浄化することが提案されている。

【０００５】しかし、排ガス浄化装置は、全体が一様に温度変化するのではなく、エンジンに近い上流部の方が下流部よりも温度が高くなる傾向があり、特に、加速時には上流部と下流部の温度差が大きくなる傾向がある。従って、上流部の温度が設定温度を越えても、下流部の温度は設定温度以下の場合があり、このような場合に、装置全体の放電をオフすると、却って排ガス浄化率が低下することがある。かといって、放電オン・オフの設定温度を高い温度に設定して放電のオフ時期を遅らせると、上流部の温度が高温になり過ぎてＮＯｘが生成されてしまうおそれがあり、却ってＮＯｘ排出量が増加してしまうおそれがある。要するに、排ガス浄化装置内の温度分布は、エンジン運転状態に応じて変化する排ガス温度や排ガス流量によって様々に変化し、排ガス浄化装置内の温度差が大きくなりやすいため、装置全体の放電を温度によって適正にオン・オフすることは困難である。しかも、排ガス浄化装置内の温度を検出する温度センサが必要になると共に、温度センサの出力に基づいて放電をオン・オフするように制御系を構成する必要があり、総じて、コスト高になる欠点がある。

【０００６】本発明はこのような事情を考慮してなされたものであり、従ってその目的は、排ガス浄化装置内の温度分布にあまり影響されずに常に高い浄化率を得ることができると共に、構成を簡単化して低コスト化の要求も満たすことができる内燃機関の排ガス浄化装置を提供することにある。

【０００７】

【課題を解決するための手段】上記目的を達成するために、本発明の請求項１は、排ガス浄化装置内の流路に放電が生じる部分（以下「放電部」という）と放電が生じない部分（以下「非放電部」という）とを混在させるように放電電極を構成し、少なくとも非放電部に触媒を設けた構成としたものである。このようにすれば、排ガス浄化装置内の流路を流れる排ガスは、放電部と非放電部を通過し、放電部を通過する過程で、放電によって浄化反応が促進され（放電部に触媒が存在する場合は放電と触媒との両方によって浄化反応が促進され）、非放電部

を通過する過程で、触媒によって浄化反応が促進される。

【０００８】一般に、図６に示すように、放電部の浄化ウインドウは、非放電部の浄化ウインドウよりも低い温度域に存在するため、非放電部の浄化ウインドウよりも低い温度の場所では、主として放電部で排ガスが浄化され、反対に、放電部の浄化ウインドウよりも高い温度の場所では、主として非放電部で排ガスが浄化される。従って、放電部と非放電部とを混在させれば、排ガス浄化装置内の温度分布がどの様に変化したとしても、放電部と非放電部のいずれかで排ガスを浄化することができ、排ガス浄化装置内の温度分布にあまり影響されずに常に高い浄化率を得ることができる。しかも、温度に応じて放電をオン・オフする必要がないため、温度センサが不要で、構成が簡単であり、低コスト化の要求も満たすことができる。

【０００９】この場合、触媒はペレット状のものを流路内に充填しても良いが、請求項２のように、流路の内壁面に触媒をコーティングするようにしても良い。このようにすれば、流路内の排気抵抗（圧力損失）を少なくすることができ、エンジン出力を低下させずに済む。

【００１０】また、請求項３のように、排ガス浄化装置内の温度分布に応じて放電部と非放電部との比率を変化させるようにしても良い。例えば、排ガス浄化装置内の温度が高くなる傾向の場所では、放電部よりも浄化ウインドウの温度が高い非放電部の比率を多くし、反対に、温度が低くなる傾向の場所では、非放電部よりも浄化ウインドウの温度が低い放電部の比率を多くすると良い。このようにすれば、排ガス浄化装置内の温度分布に応じて放電部と非放電部とを効率良く使用して排ガスを浄化することができ、排ガス浄化率を高めることができる。

【００１１】この場合、請求項４のように、排ガス浄化装置内の上流部の方が下流部よりも放電部が少なくなるように構成しても良い。つまり、排ガス浄化装置は、全体が一様に温度変化するのではなく、内燃機関に近い上流部の方が下流部よりも温度が高くなる傾向があるため、上流部の方が下流部よりも放電部が少なくなるように構成すれば、放電部と非放電部との比率を排ガス流れ方向の温度分布に対応させることができる。

【００１２】一般に、排ガス浄化装置内の排ガス流量は、一様ではなく、中央部で多く、周辺部で少なくなり、排ガス流量が多い中央部は、排ガス流量が少ない周辺部よりも温度が高くなる傾向がある。

【００１３】この点を考慮して、請求項５のように、排ガス浄化装置内の中央部の方が周辺部よりも放電部が少なくなるように構成しても良い。このようにすれば、放電部と非放電部との比率を、排ガス流量分布により生じる温度分布に対応させることができる。

【００１４】また、請求項６のように、流路内を流れる全ての排ガスが少なくとも１回は放電部を通過するように放電部と非放電部とを配置すると良い。このようにすれば、流路内を流れる全ての排ガスを確実に放電場にさらすことができ、放電による排ガス浄化効果を高めることができる。

【００１５】

【発明の実施の形態】［実施形態（１）］以下、本発明の実施形態（１）を図１乃至図６に基づいて説明する。図５に示すように、排ガス浄化装置１１は、内燃機関であるエンジン１２の排気管１３の途中に設けられている。この排ガス浄化装置１１の浄化ハウジング１４は、多くの流路１５を形成するために、排気管１３よりも太く形成されている。

【００１６】図１に示すように、浄化ハウジング１４内には、２種類の絶縁基板１６，１７が所定間隔で交互に平行に配置され、各絶縁基板１６，１７間に排ガスが通過する偏平な流路１５が形成されている。各絶縁基板１６，１７は、放電の生じやすい誘電性のある耐熱性絶縁体（例えばアルミナ等のセラミック、ガラス等）で形成され、各絶縁基板１６，１７の表面（流路１６の内壁面）には、排ガスの浄化反応を促進させる触媒（図示せず）がコーティングされている。

【００１７】各絶縁基板１６，１７の内部には、図２及び図３に示すように、複数の放電電極１８，１９が印刷導体又は導電板によって形成されている。各流路１５の上面又は下面の絶縁基板１６は、図２に示すように、複数の帯状の放電電極１８が排ガス流れ方向と直角に延びるように形成され、各放電電極１８が該絶縁基板１６の左端部に形成された接続端子部２０に接続されている。この絶縁基板１６と対向する絶縁基板１７は、図３に示すように、複数の帯状の放電電極１９が排ガス流れ方向と平行に延びるように形成され、各放電電極１９の一端がこれと一体に形成された接続導体２１によって接続され、この接続導体２１が絶縁基板１７の右端部に形成された接続端子部２２に接続されている。

【００１８】図１に示すように、各流路１５の片面側の絶縁基板１６の接続端子部２０はグランド側に接続され、この絶縁基板１６と対向する絶縁基板１７の接続端子部２２は、例えば高周波の交流高電圧を発生する高電圧発生装置２３の出力端子に接続されている。これにより、高電圧発生装置２３の動作時には、各流路１５を挟んで対向する複数の帯状の放電電極１８，１９間に高周波の交流高電圧が印加され、各流路１５内で放電が発生する。

【００１９】この場合、各流路１５を挟んで対向する上下の放電電極１８，１９は、上方から見て直交するように並んでいるため、上下の放電電極１８，１９が対向する部分（上方から見て重なり合った部分）のみで放電が発生し、それ以外の部分では放電が発生しない。これにより、各流路１５には、放電が発生する放電部Ａと、放電が発生しない非放電部Ｂとが混在している。本実施形

態（１）では、図４に示すように、流路１５内に多数の放電部Ａが縦横に所定間隔で配列され、各放電部Ａの周囲を取り巻くように非放電部Ｂが形成されている。

【００２０】以上説明した本実施形態（１）では、排ガス浄化装置１１内の各流路１５に放電部Ａと非放電部Ｂとが混在しているため、各流路１５を流れる排ガスは、放電部Ａと非放電部Ｂを通過し、放電部Ａを通過する過程で、放電と流路１５内壁の触媒の両方によって浄化反応が促進され、非放電部Ｂを通過する過程で、触媒によって浄化反応が促進される。

【００２１】一般に、図６に示すように、放電部Ａの浄化ウインドウは、非放電部Ｂの浄化ウインドウよりも低い温度域に存在するため、非放電部Ｂの浄化ウインドウよりも低い温度の場所では、主として放電部Ａで排ガスが浄化され、反対に、放電部Ａの浄化ウインドウよりも高い温度の場所では、主として非放電部Ｂで排ガスが浄化される。従って、各流路１５に放電部Ａと非放電部Ｂとを混在させれば、排ガス浄化装置１１内の温度分布がどの様に変化したとしても、放電部Ａと非放電部Ｂのいずれかで排ガスを浄化することができ、排ガス浄化装置１１内の温度分布にあまり影響されずに常に高い浄化率を得ることができる。しかも、温度に応じて放電をオン・オフする必要がないため、温度センサが不要で、構成が簡単であり、低コスト化の要求も満たすことができる。

【００２２】［実施形態（２）］上記実施形態（１）では、図４に示すように、非放電部Ｂが排ガス流れ方向に沿って流路１５の両端まで延びているため、排ガス浄化装置１１内に流入した排ガスの一部が非放電部Ｂのみを通って排ガス浄化装置１１から流出してしまうおそれがある。

【００２３】そこで、本発明の実施形態（２）では、図２の絶縁基板１６を所定間隔で複数枚平行に配置し、各流路１５の上下の放電電極１８を対向させることで、図７に示すように、流路１５に複数の帯状の放電部Ａを所定間隔で排ガス流れ方向と直角に延びるように形成し、各放電部Ａ間に非放電部Ｂを形成している。

【００２４】この構成では、放電部Ａと非放電部Ｂが流路１５を直角に横切ってその左右両端まで延びているので、流路１５内を流れる全ての排ガスが放電部Ａと非放電部Ｂとの両方を必ず通過するようになり、より高い浄化率を得ることができる。

【００２５】［実施形態（３）］図８及び図９に示す本発明の実施形態（３）では、絶縁基板３１に放電電極３２を千鳥状に連続して形成し、この絶縁基板３１を所定間隔で複数枚平行に配置し、各流路１５の上下の放電電極３２を対向させることで、図９に示すように、流路１５に放電部Ａと非放電部Ｂとを千鳥状に形成している。本実施形態（３）でも、前記実施形態（２）と同じく、流路１５内を流れる全ての排ガスが放電部Ａと非放電部Ｂとの両方を必ず通過するようになり、より高い浄化率を得ることができる。

【００２６】［実施形態（４）］排ガス浄化装置は、全体が一様に温度変化するのではなく、エンジンに近い上流部の方が下流部よりも温度が高くなる傾向がある。そこで、本発明の実施形態（４）では、図１０に示すように、流路１５に複数の帯状の放電部Ａと非放電部Ｂとを交互に排ガス流れ方向と直角に延びるように形成すると共に、放電部Ａの幅を上流部の方が下流部よりも狭くなるように形成することで、上流部の方が下流部よりも放電部Ａが少なくなるように構成している。このようにすれば、排ガス浄化装置内の温度分布に応じて放電部Ａと非放電部Ｂとを効率良く使用して排ガスを浄化することができ、排ガス浄化率を高めることができる。

【００２７】［実施形態（５）］排ガス浄化装置内の排ガス流量は、一様ではなく、中央部で多く、周辺部で少なくなり、排ガス流量が多い中央部は、排ガス流量が少ない周辺部よりも温度が高くなる傾向がある。

【００２８】この点を考慮して、本発明の実施形態（５）では、図１１に示すように、流路１５に複数の帯状の放電部Ａと非放電部Ｂとを交互に排ガス流れ方向と直角に延びるように形成すると共に、放電部Ａの幅を中央部の方が周辺部よりも狭くなるように形成することで、中央部の方が周辺部よりも放電部Ａが少なくなるように構成している。このようにすれば、放電部Ａと非放電部Ｂとの比率を、排ガス流量分布により生じる温度分布に対応させることができ、放電部Ａと非放電部Ｂとを効率良く使用して排ガスを浄化することができる。

【００２９】尚、本実施形態（５）においても、前記実施形態（４）と同じく、各放電部Ａの幅を上流部の方が下流部よりも狭くなるように形成して、上流部の方が下流部よりも放電部Ａが少なくなるように構成しても良い。

【００３０】その他、本発明は、上記各実施形態に限定されず、放電電極や放電部Ａ（非放電部Ｂ）の形状・配置パターンを適宜変更したり、排ガスの流路をハニカム状に形成しても良い。

【００３１】また、上記各実施形態では、放電部Ａと非放電部Ｂの両方に触媒がコーティングされているが、非放電部Ｂのみに触媒をコーティングしても良い。また、触媒のペレットを流路内に充填するようにしても良い。

【図面の簡単な説明】

【図１】実施形態（１）の排ガス浄化装置の縦断正面図

【図２】絶縁基板の横断面図

【図３】図２の絶縁基板と対向させる他の絶縁基板の横断面図

【図４】実施形態（１）の放電部Ａと非放電部Ｂとの配置パターンを示す平面図

【図５】排ガス浄化システム全体の概略構成図

【図６】放電部Ａの浄化ウインドウと非放電部Ｂの浄化

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ウインドウとの関係を説明する浄化特性図

【図７】実施形態（２）の放電部Ａと非放電部Ｂとの配置パターンを示す平面図

【図８】実施形態（３）の絶縁基板の横断面図

【図９】実施形態（３）の放電部Ａと非放電部Ｂとの配置パターンを示す平面図

【図１０】実施形態（４）の放電部Ａと非放電部Ｂとの配置パターンを示す平面図

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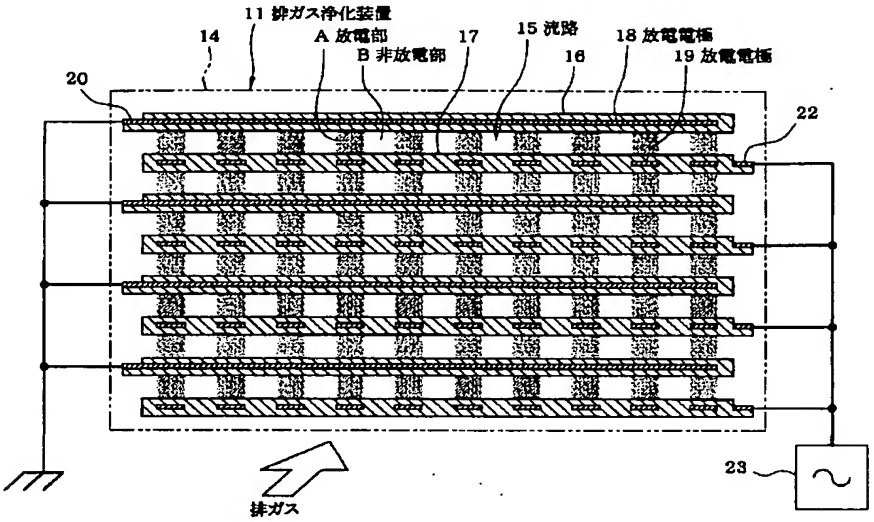
＊【図１１】実施形態（５）の放電部Ａと非放電部Ｂとの配置パターンを示す平面図

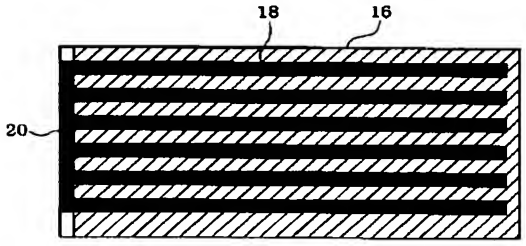
【符号の説明】

１１…排ガス浄化装置、１２…エンジン（内燃機関）、１３…排気管、１４…浄化ハウジング、１５…流路、１６，１７…絶縁基板、１８，１９…放電電極、２３…高電圧発生装置、Ａ…放電部、Ｂ…非放電部。

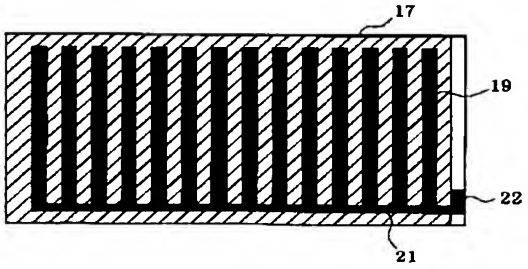
【図１】



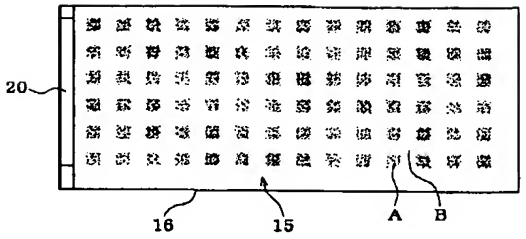
【図２】



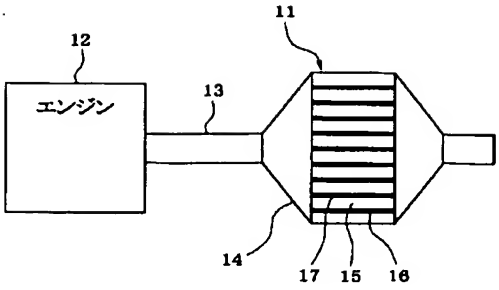
【図３】



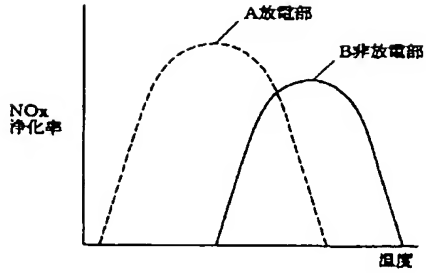
【図４】



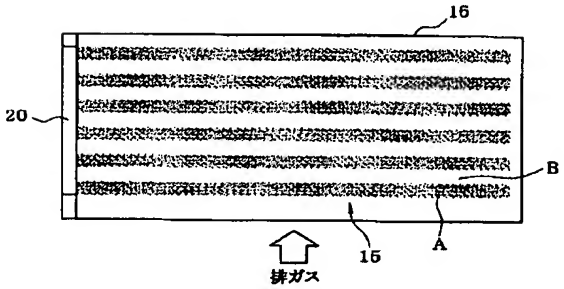
【図５】



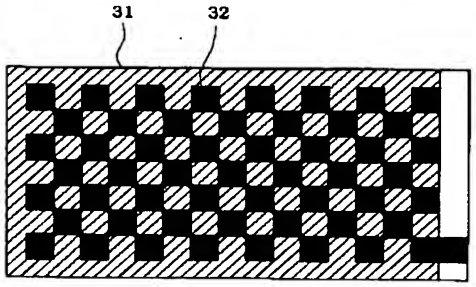
【図６】



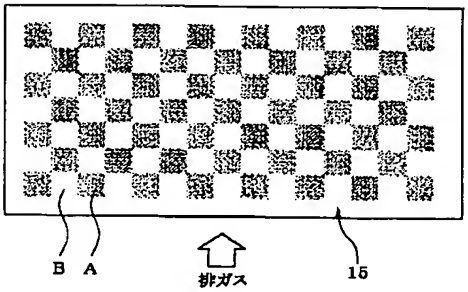
【図７】



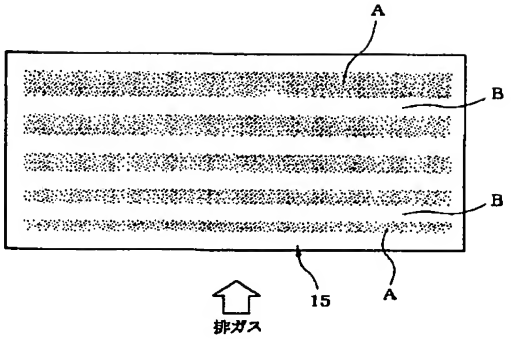
【図８】



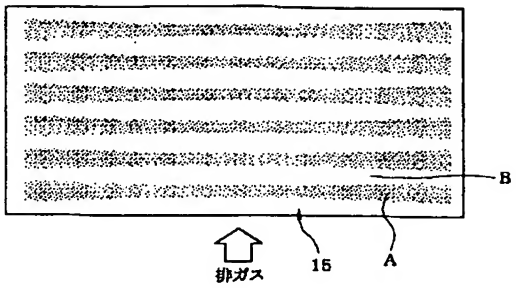
【図９】



【図１０】



【図１１】



フロントページの続き

(51)Int.Cl.'	識別記号	Ｆ Ｉ	ﾃｰﾏｺｰﾄﾞ (参考)
Ｆ０１Ｎ　3/28	３０１	Ｂ０１Ｄ　53/36	１０１Ａ